

# World Energy Outlook: Why Japan needs nuclear power

March 2014

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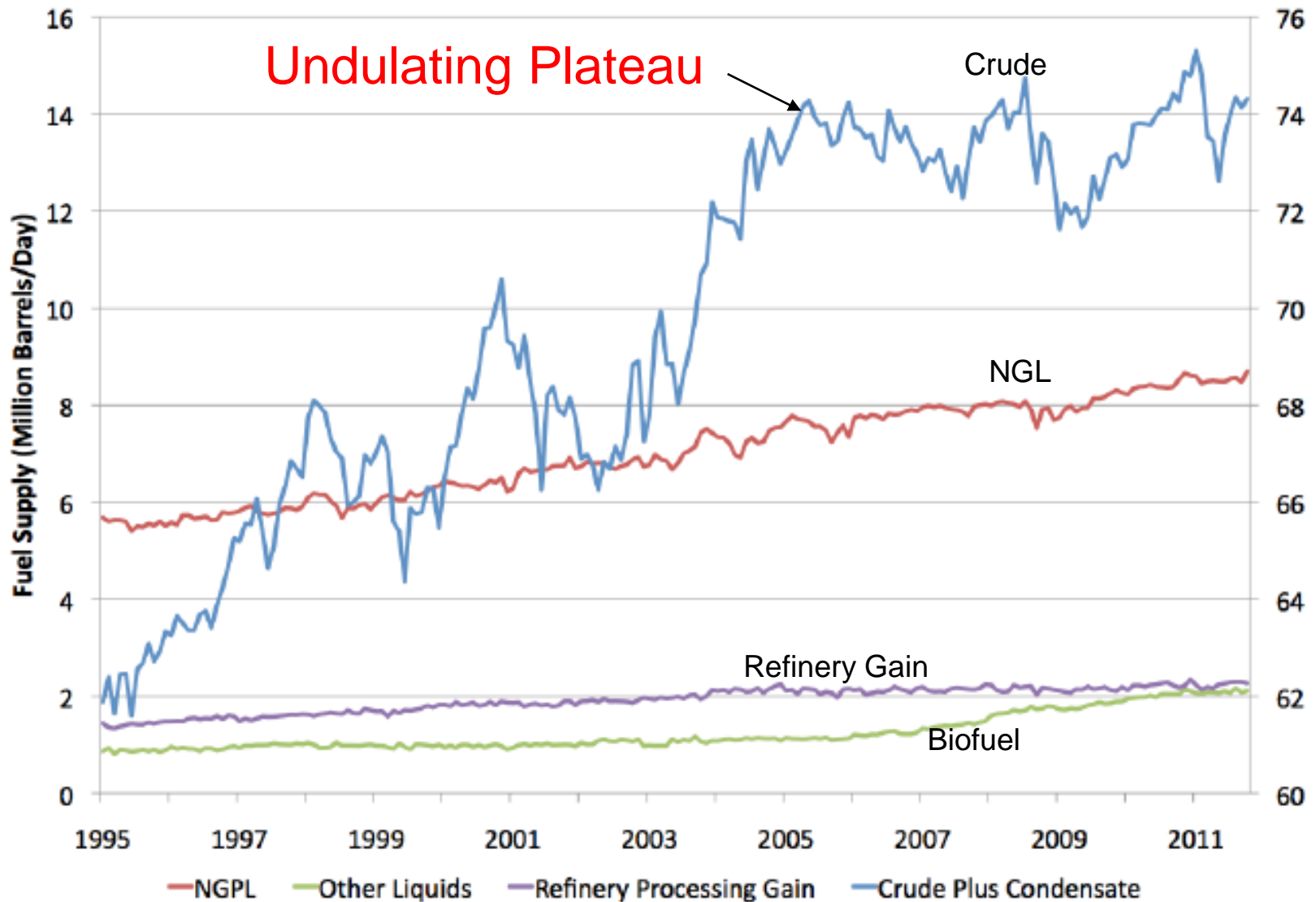
# Contents

- Resources for electricity generation:  
Fossil Fuel (Oil, Gas, Coal) and  
Renewables ( Hydro, Solar, Wind, etc.)
- Inevitable peak & decline of fossil fuel  
production
- Limits of renewable energy
- Climate change & CO<sub>2</sub> emissions
- Importance of Nuclear Power for Japan

# Fossil Fuel Production

- Uneven resource distribution (Middle East)
- Long distance and costly haulage for international trade with weak choke points
- Degrading resources: Low hanging fruits are already picked. “Time of easy oil is over.”
- Remained frontiers are deep sea and arctic.
- Started recovery from unconventional resources which are mostly of low quality.
- Lowering productivity causes increasing cost and higher market price.

# Trend of Crude Production



# Conventional Oil

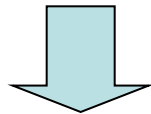
- Crude production from Current Oil Fields is declining at a rate of 4.1% per year (3 million barrels per day ).
  - ➡ A Saudi Arabia is necessary every 3 years.
- Increase of liquid production comes from unconventional resources (like US shale oil ,Canada oil sand), NGL, and Biofuel, but all these resources may have limitation.

# Unconventional: Shale Oil

- How to distinguish Conventional or Unconventional

When you put a drill hole, conventional oil & gas gush out by high underground pressure, but unconventional one never gush out .

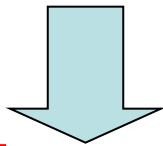
- Shale rock's permeability (flow ability of gas and liquid) is 1/10,000 to 1/1,000,000 in comparison to conventional sandstone type deposit.



**BIG Handicap**

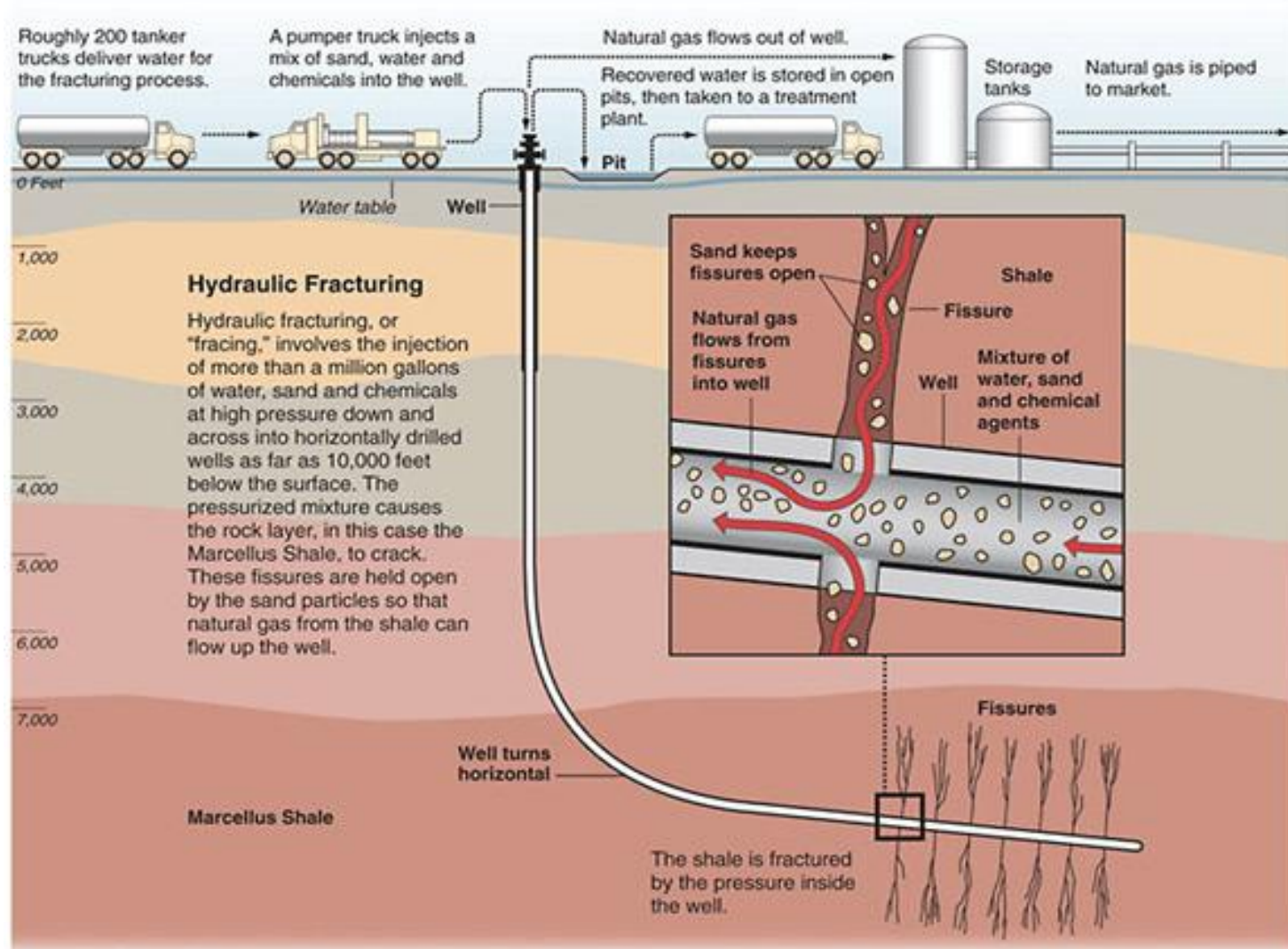
# How to overcome the handicap?

- Horizontal level drilling
- Multiple stages Fracking (hydraulic fracturing)
- Search for sweet spots ( which may have natural micro fractures and high carbon content)



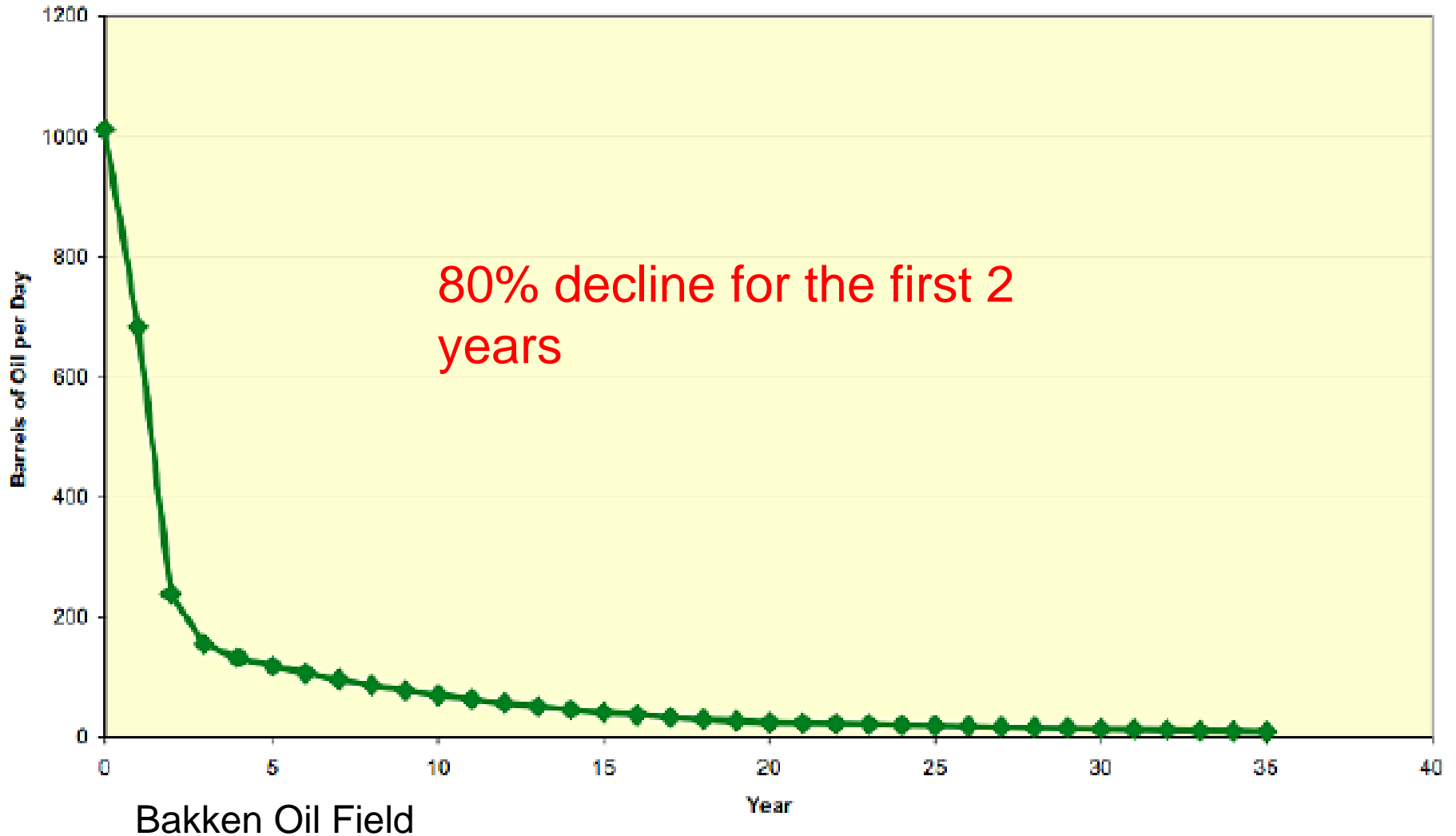
- **High production cost** (\$50-80/bbl oil and \$4-9/MBtu gas)

# How to produce shale oil & gas?



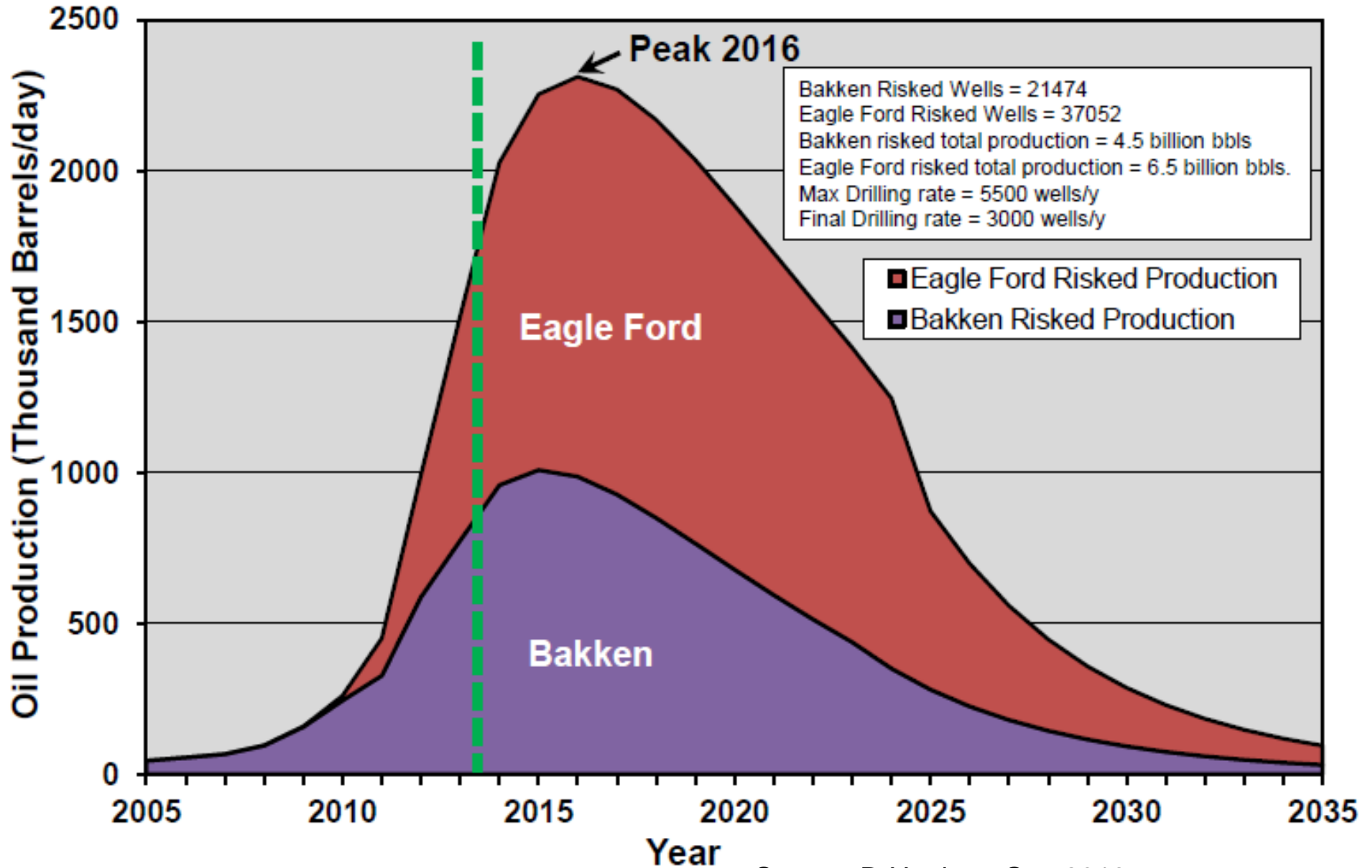


# Biggest Problem: Very High “Well Decline Rate”

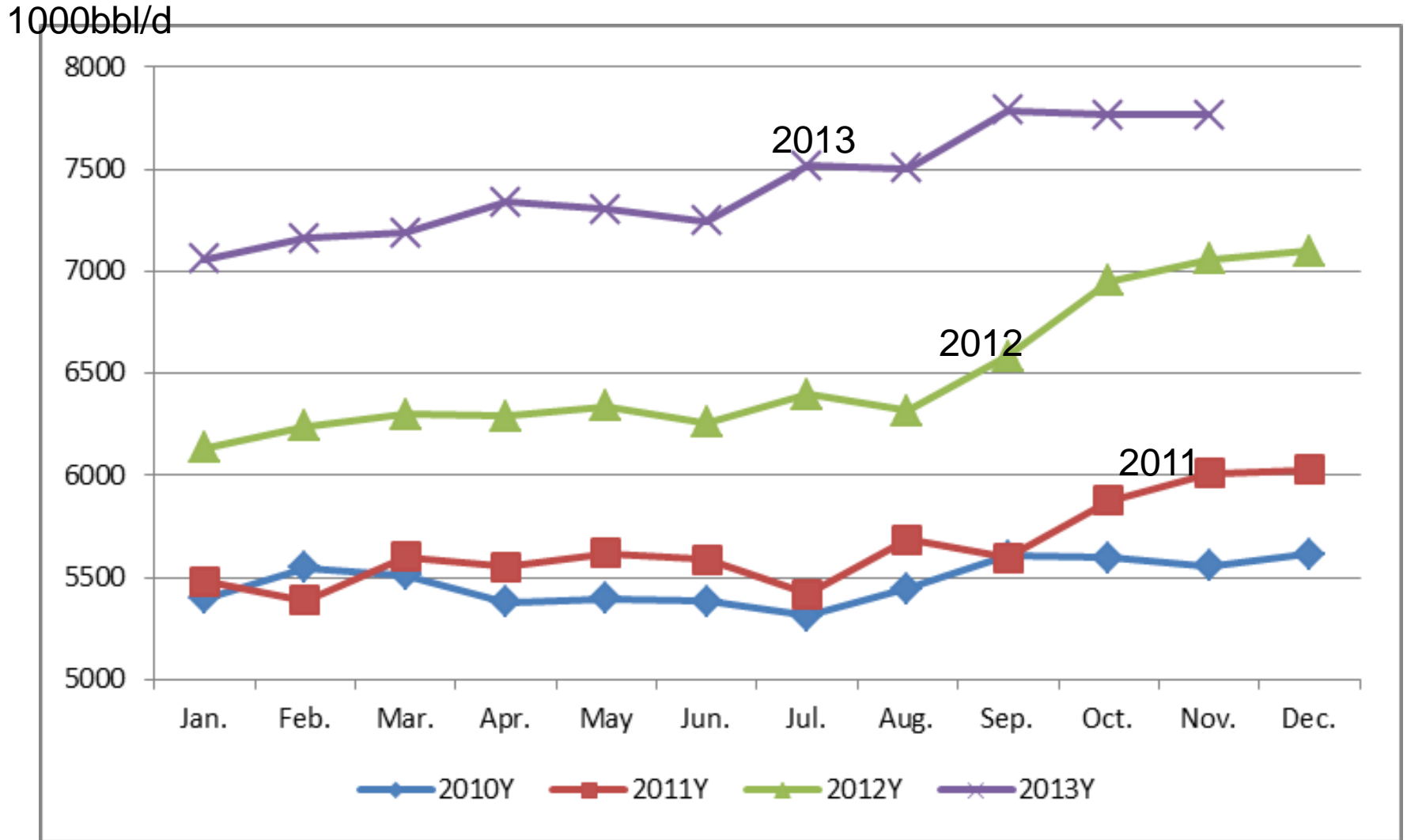


Source: The Oil Drum April 1, 2012

# Big 2 shale oil fields production



# US Monthly Crude Production

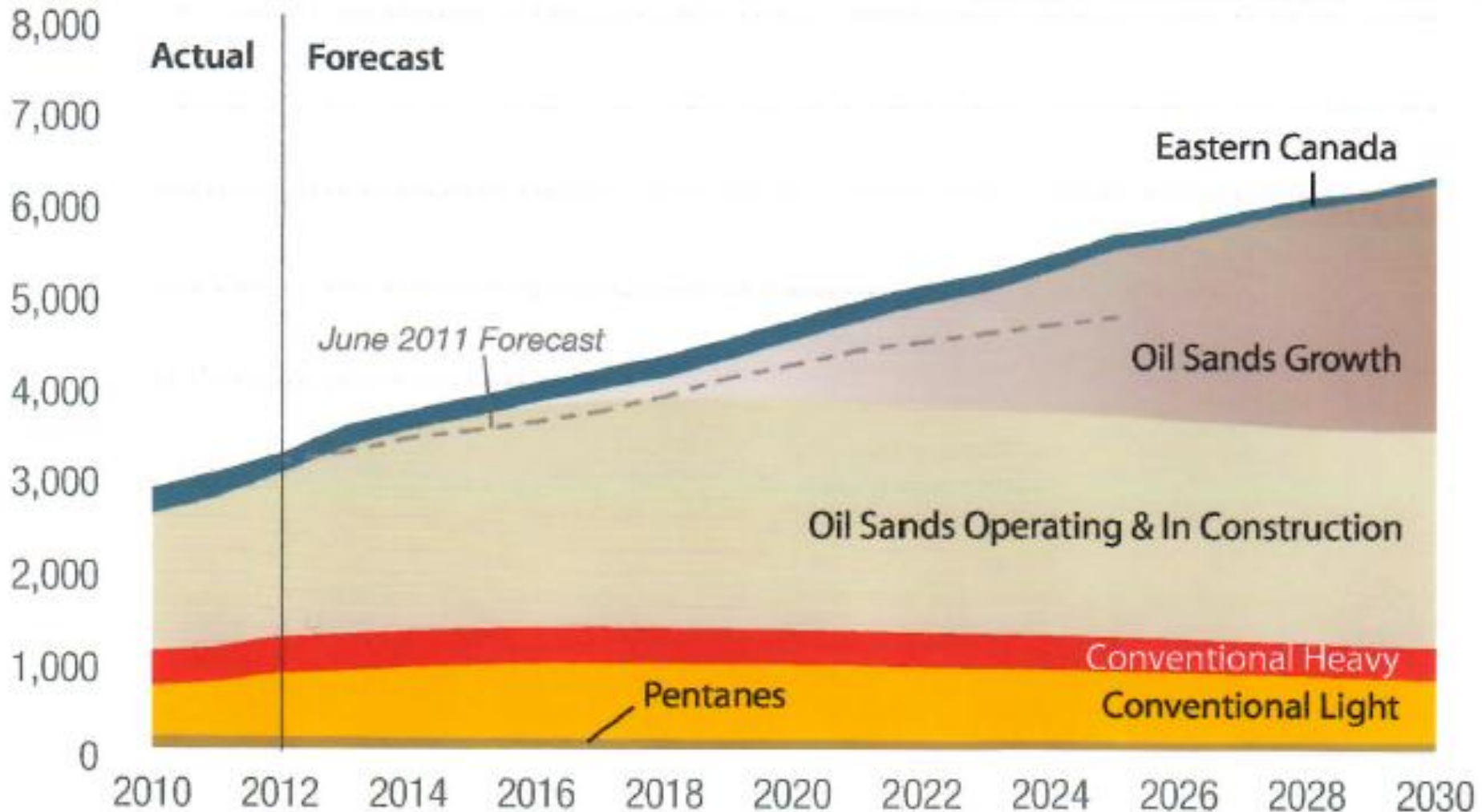


Source: Compiled the chart using EIA" Oil Monthly" figures

# Unconventional: Canadian Oil Sands



# Production Forecast (Oil Sands)

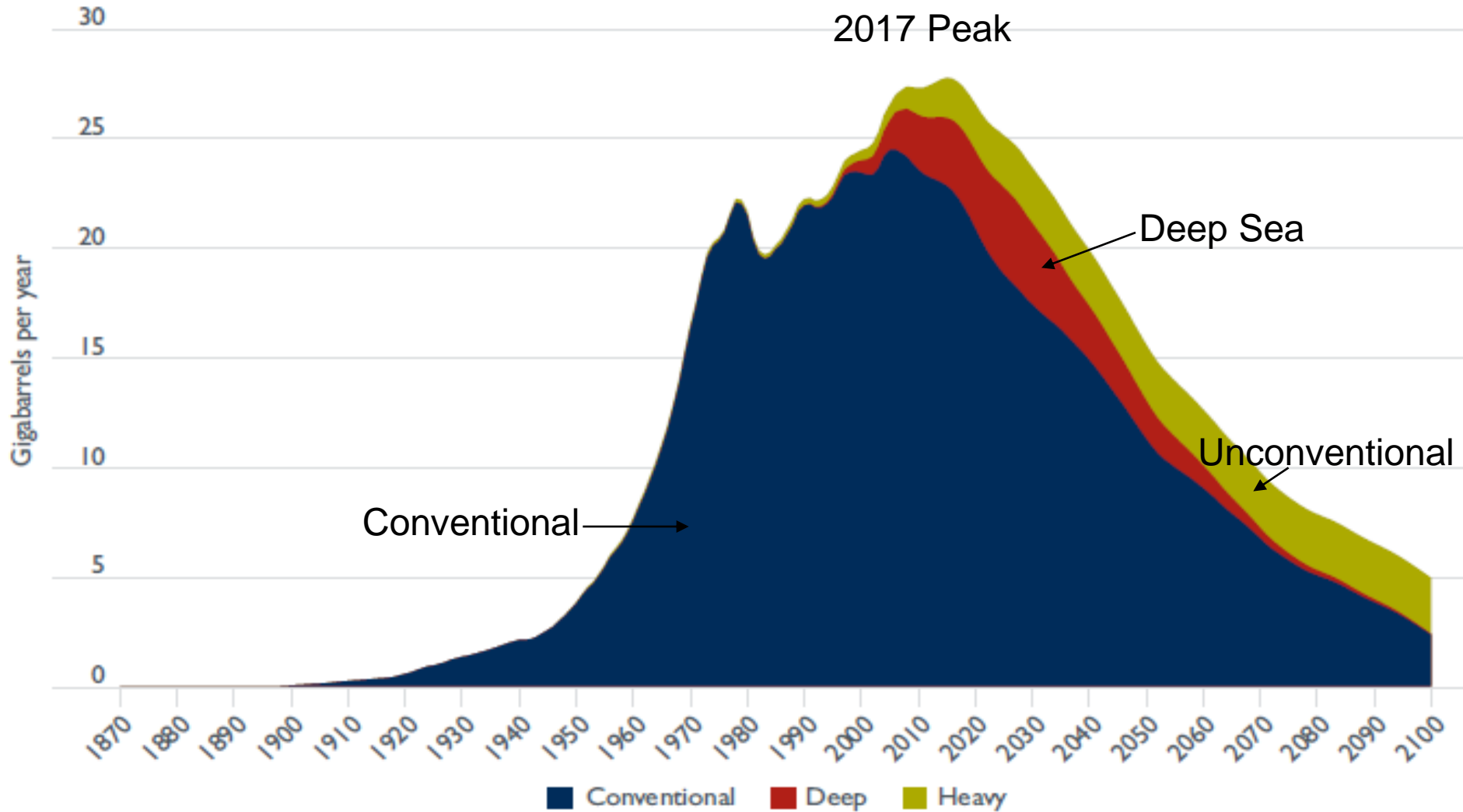


Source: Canadian Association of Petroleum Producers 2012 Report

# Unconventional Oil Summary

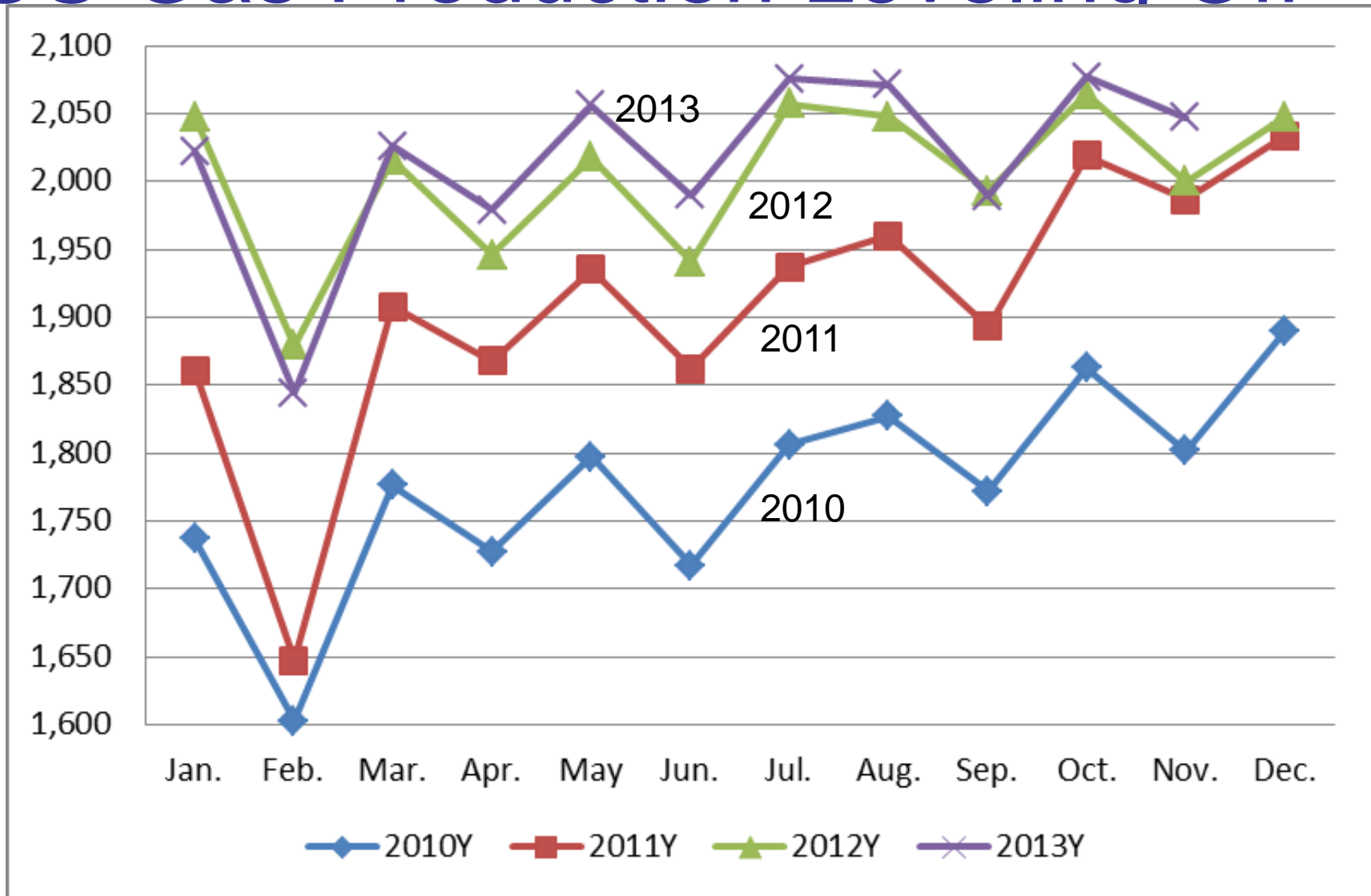
- US shale oil will probably peak out at 3 million barrels per day in late 2010's, which is 4% of world crude production.
- Production from Canadian oil sand may increase further 3 million barrels per day in 20 years, which is 4% of world production.
- These altogether may form a small bump on the world oil production curve.

# World Oil Production Simulation



Source: Australia BITRE Report 117

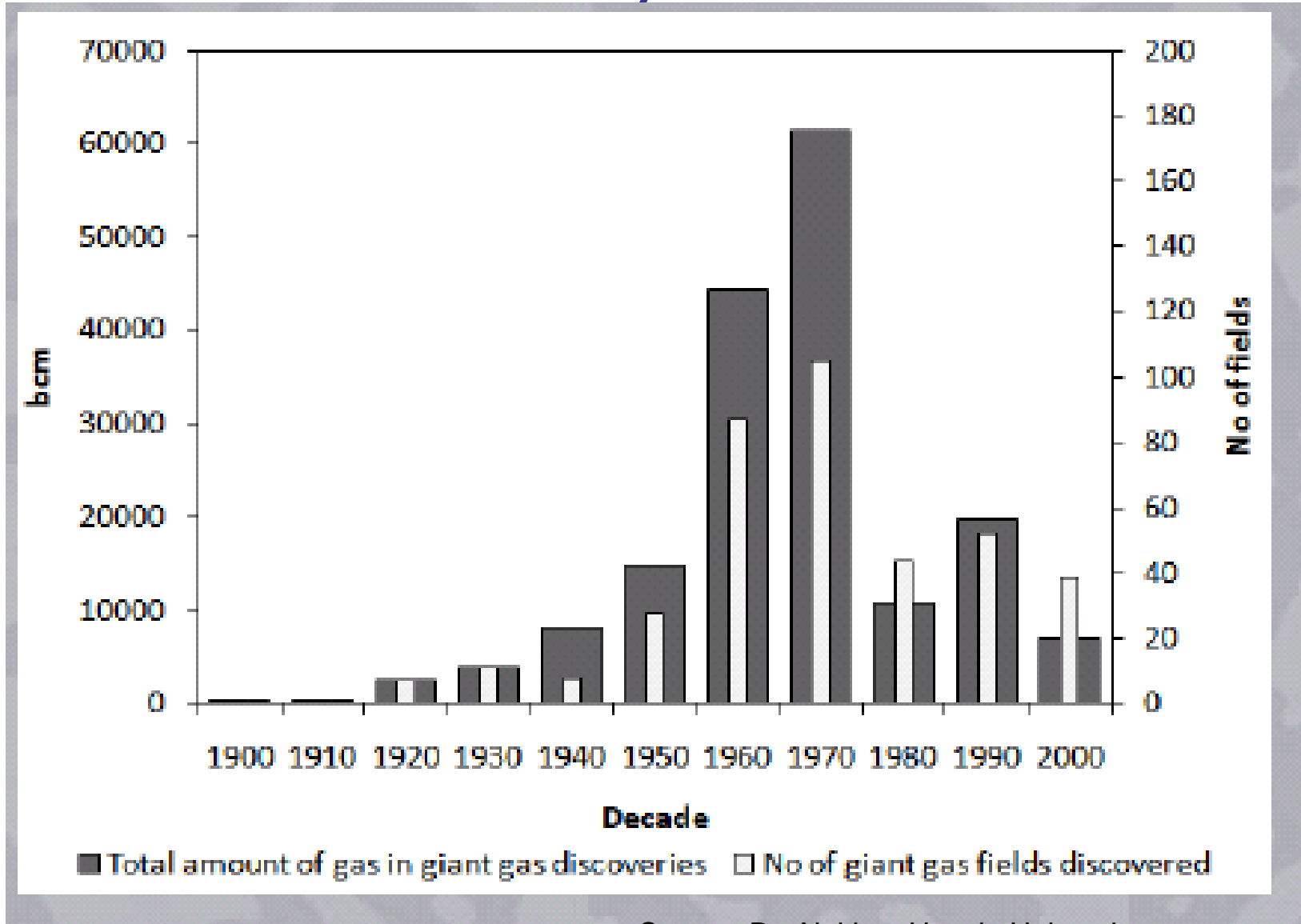
# US Gas Production Leveling Off



Source: Compiled the chart using EIA "Gas Monthly" figures

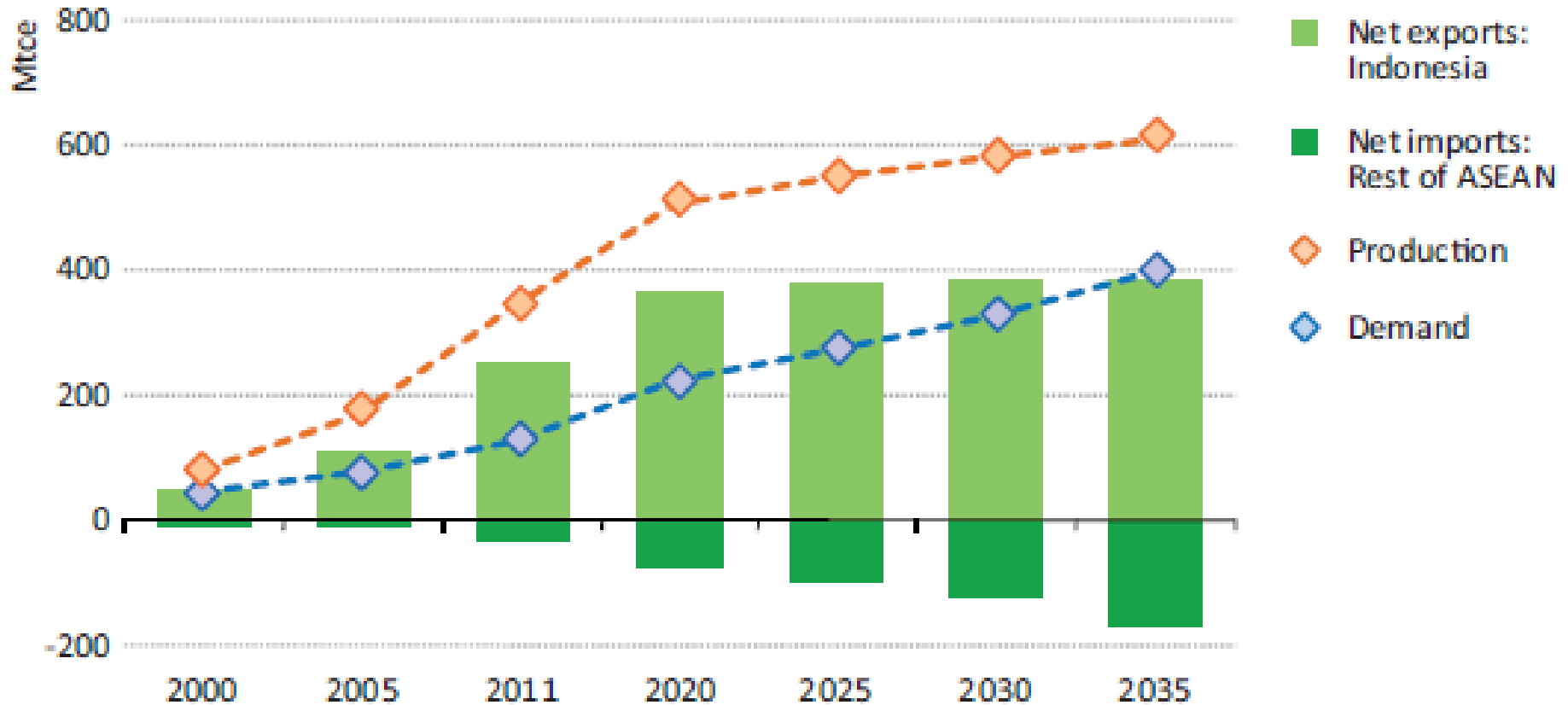


# Peak Discovery of Natural Gas



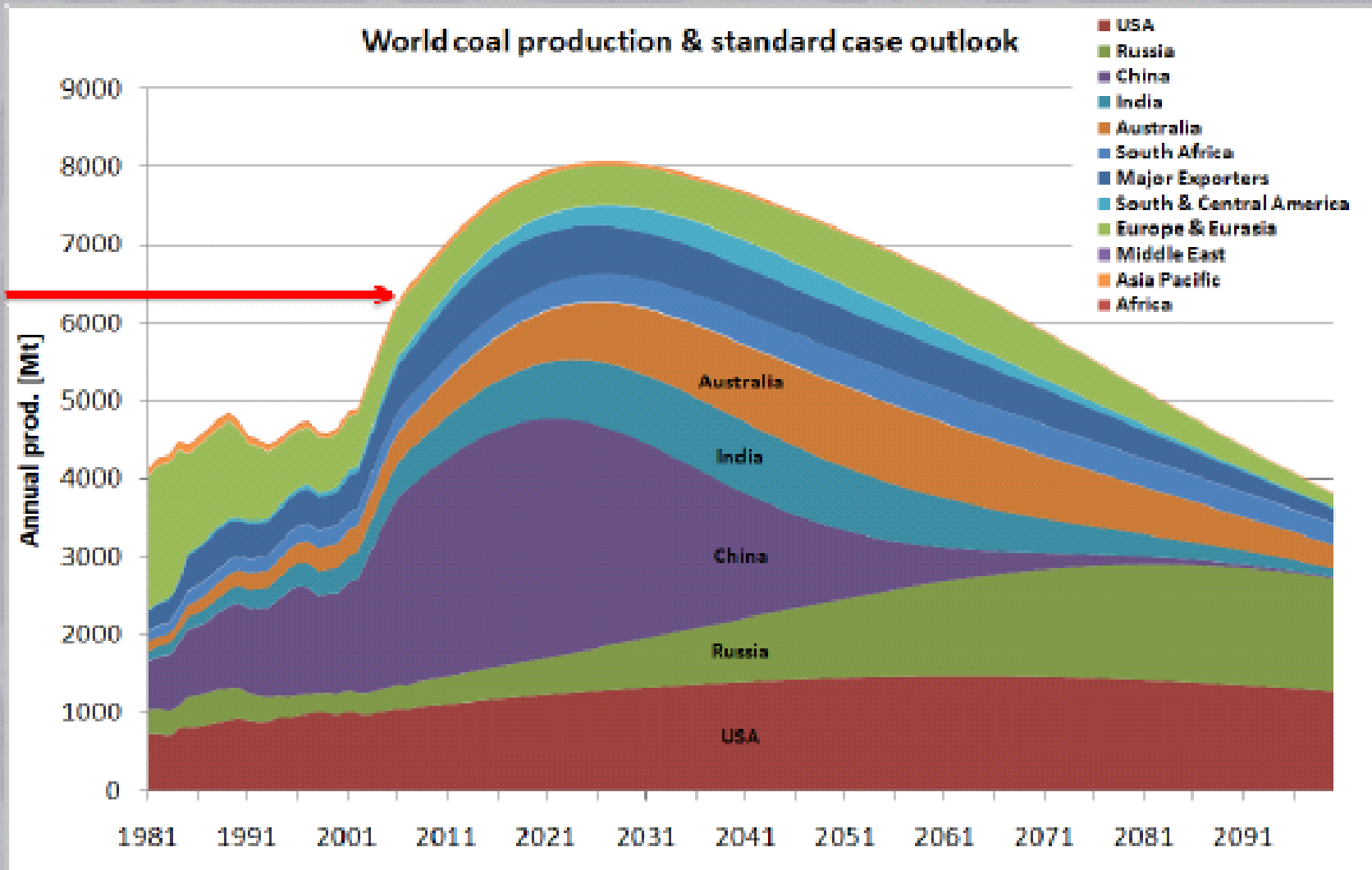
Source: Dr. Aleklett, Upsala University

# ASEAN coal balance



# Peak Coal

2006



Source: Dr. Aleklett, Upsala University

# Limits of Renewable Energy

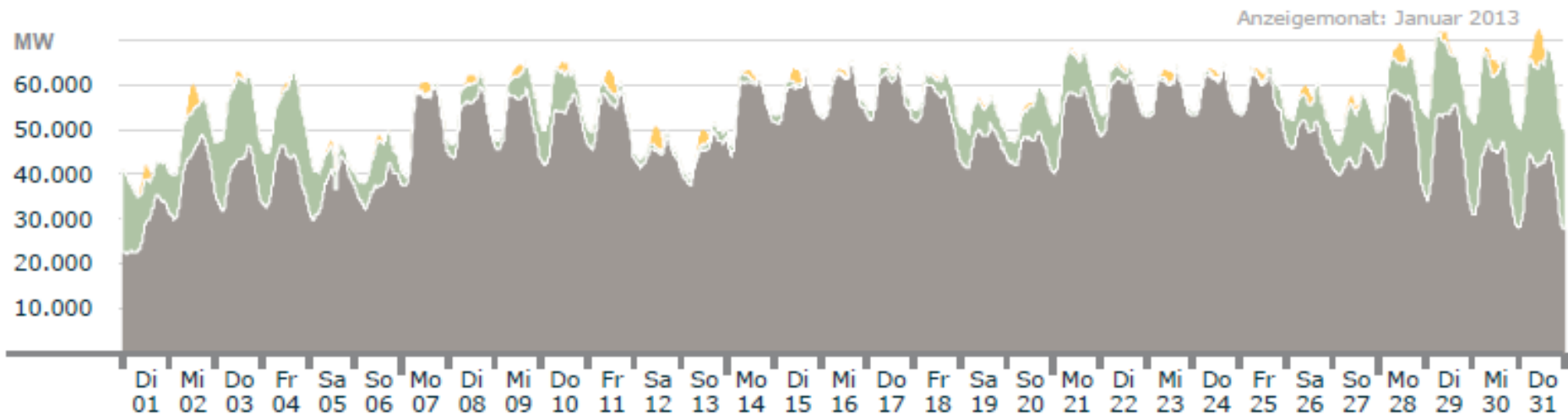
- Wind and solar is intermittent.
- They contribute only about **2%** to firm capacity (capacity that can be relied upon to generate electricity at any given time).

IEA “World Energy Outlook 2013”

- They need back-up facilities (like gas and oil fired power plants for short fluctuation as well as coal and nuclear power plants for long down time).

# Solar & Wind Power in January

## Tatsächliche Produktion

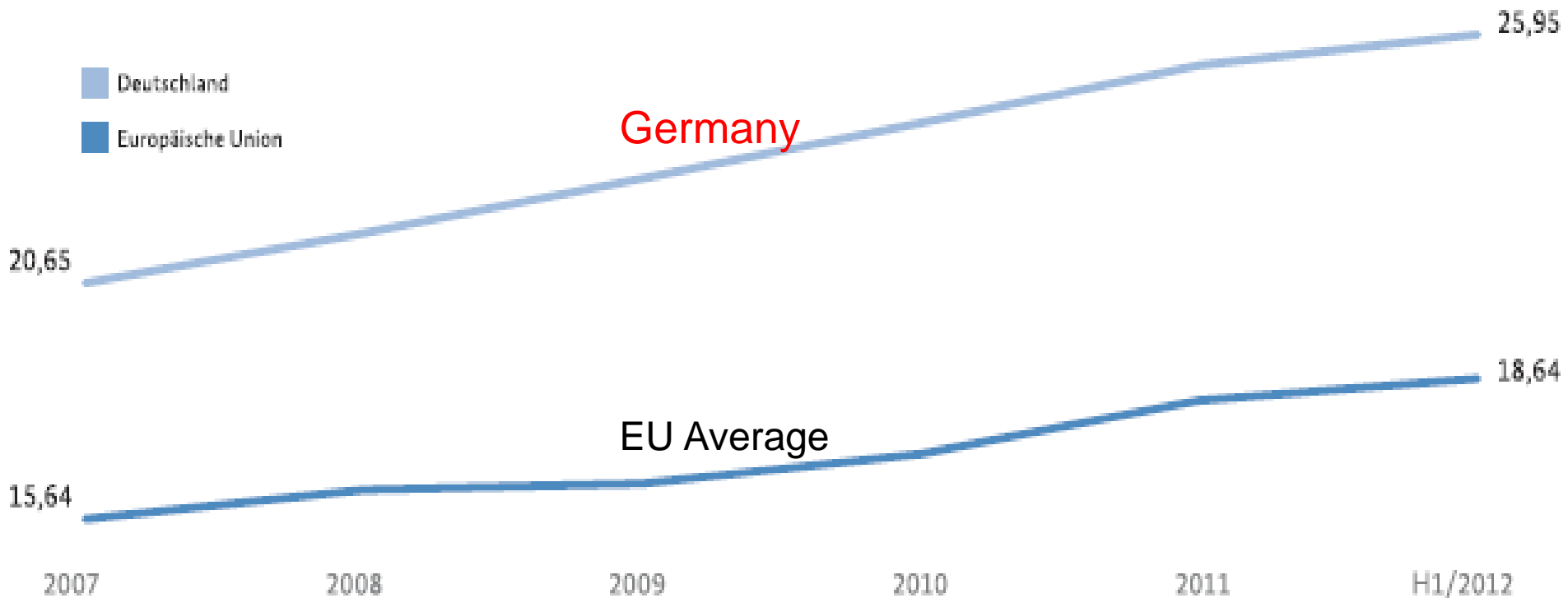


	Max. Leistung	Datum max. Leistung	Monatsenergie
Solar	8,4 GW	31.01., 12:00 (+1:00)	0,35 TWh
Wind	23,3 GW	31.01., 18:30 (+1:00)	5,0 TWh
Konventionell > 100 MW	64,8 GW	16.01., 17:00 (+1:00)	36,3 TWh



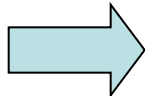
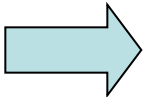
# Household Electricity Charge

Europäische Strompreise für Haushaltskunden (inkl. Steuern und Abgaben)  
in ct/kWh



Quelle: Eurostat

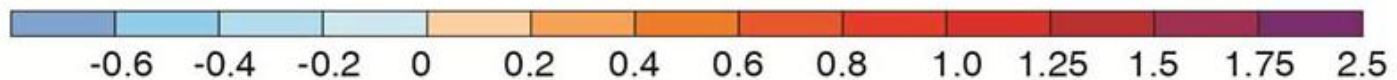
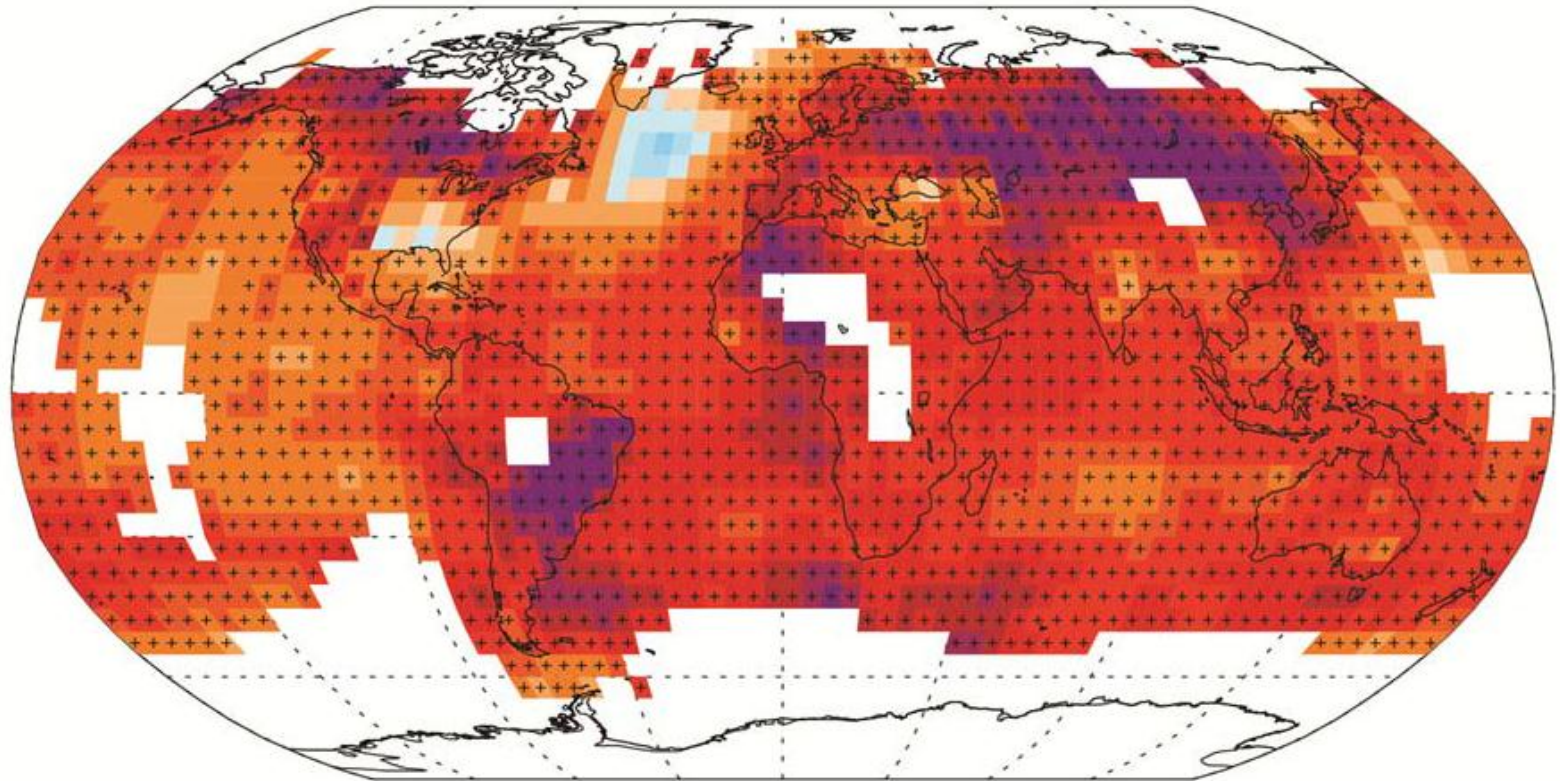
# What happened in Germany?

- A standard household (300kWh/month) has to pay electricity charge as high as US\$1,500 (15million IDR) per year.
- Despite of 68GW increase by sun & wind power, thermal power plants have to be kept operation.
- As a result 178GW total capacity vs. 80GW peak load  Surplus capacity (2.2 times)
- Lower working ratio & lower wholesale market price  Poor profit damages utilities

**NOT SUSTAINABLE**

# Climate change and CO2 emission

Observed change in average surface temperature 1901–2012



Trend (°C over period)

Source: IPCC WG1 5<sup>th</sup> Assessment report

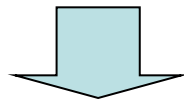


# IPCC 5<sup>th</sup> Assessment Report

- Human influence has been detected in warming of the atmosphere and the ocean, in global mean sea level rise, and in changes in some **climate extremes**.
- It is **extremely likely** that human influence has been the dominant cause of the observed warming since mid-20<sup>th</sup> century.  
( 95% confidence)

# Why Japan needs Nuclear Power

- Only 4% self-supply for our primary energy needs
- 90% oil dependence on Middle East
- Only 2 weeks' LNG stockpile
- Long haulage routes with several choke points for oil & gas
- Decreasing exportability of oil producing countries
- Even if we built 68GW Renewable Power (32GW Wind and 36GW PV like Germany), we can supply only 9.4% of our electricity demand. Still need back-up power stations.



**SECURITY of SUPPLY** is of OUR UTMOST IMPORTANCE

# continues

- As a member of G8 countries, Japan committed 80% CO<sub>2</sub> reduction by 2050.
- Thus, we are not supposed to expand coal fired power plants.

# Summary

- Fossil fuels' production peak is inevitable in not so distant future.
- With their low quality nature, unconventional oil and gas will not be of much help in supply.
- Intermittent nature of solar and wind energy requires a full size back-up power system. Heavy financial burden on customers will also cause some limits on their development.
- Japan definitely needs nuclear power in view of its energy security and global climate change.

Thank you for your attention!